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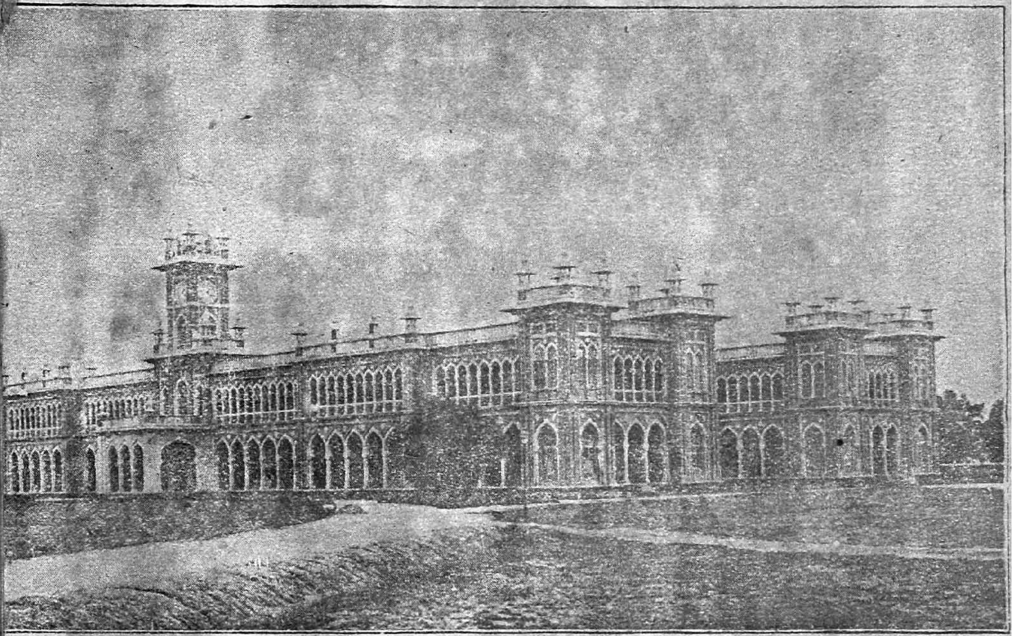
XLI January 1954 No. 1



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The Late Rao Bahadur S. SUNDARARAMIER

The news of the death of Mr. S. Sundararamier, former Mycologist, Government of Madras, at Kumbakonam on Friday the 22nd January 1954 must have come as a shock to many of his old colleagues and students and members of the Union. Having retired in 1936 after a long and meritorious service of 31 years, the late Mr. Iyer, had of course lived to the Psalmist's "Three score years and ten", but he had been maintaining such good health and active habits during his retirement that the end just now was unexpected.

Mr. Sundararamier was born in the year 1881 in a very cultured family of South India. His father the late Mr. S. Subramani Iyer was a veteran educationist and a well known figure in the educational department, in the early years of this century. Mr. Sundararamier after a brilliant academic career, underwent his early training under Dr. Butler, the eminent Mycologist. Entering the Agricultural Department as an assistant in Botany, he gradually rose step by step until in 1922, he was elevated to the Imperial Service as Government Mycologist, Madras. He held this post till 1936, when he retired.

The remarkable feature of Mr. Sundararamier's work and administration as a Mycologist was his practical outlook, full of commonsense he had the knack of putting across to the ryots, remedial measures in language which they easily understood, and with equipment they could easily get hold of. In fact, he emphasised more attention on the utilitarian aspect than on the fundamental side of research.

Simple and unassuming in habits, shunning the limelight, sincere in his devotion to duty and service to the cultivators, Mr. Sundararamier endeared himself to his colleagues and students. He was intimately connected with the Union from its inception and was its Vice-President in the Jubilee year. He was also connected with the Officers' Club, the Public Servants Co-operative Society, the Association of Economic Biologists, in all of which he was President during various periods.

To his wife, who survives him and to the members of his bereaved family, the Union conveys its heartfelt condolences.

May his soul rest in peace.

The Madras Agricultural Journal

Vol. XLI January 1954 No. 1

Editorial

The theory of agricultural practices seems to be in recent times taking a turn towards the older ones, especially, in reference to India. In this country it was vehemently advocated that the native wooden chisel plough was very defficient and for a good farming iron mould board ploughs capable of turning the soil should be used. Quite a large number of them was manufactured to suit the Indian conditions. A clean level field with no weeds growing nor any other disfiguring stubbles left on the field was held as the ideal. Constant working of the barrows and occasional deep ploughing etc., were advocated. Even stones and pebbles were not allowed to be left in the field. Advocacy on manures, however, was more cautious, yet the stress was more towards the chemical fertilizers. Recent investigations have shifted the weight again. It is now advocated that it is better to leave the soil undisturbed and for this a chisel plough which just works undersurface, and breaks the pan created by working of heavier iron ploughs is advised. The stubbles are to be left in the field and the latter left in as rough a manner as possible since a finely worked, clean surface is liable to get compacted with the first rains and thus more water run off than absorbed. It is said further to lower the soil erosion. Organic manures especially farm yard manure recommended as the best method of improving the soil, encouraging the growth of soil microflora and fauna and preventing certain pathological conditions in the plants. Pebbles and stones unless they are flat granites which might prevent root and water penetration are now to be left in the field since they add to the soil by gradual disintigration and supply some of the precious rare elements found to be so necessary now for plant growth. We are also told that land which has been put to grass for a few

seasons recovers its fertility quickly and at the same time soil erosion is checked. Thus it becomes evident that some of the time honoured practices though emperical may after all be found to have a fundamental basis and should be carefully investigated before rejection or substitution.

Republic Day: On the 26th of January the fourth anniversary of the Republic of India was observed throughout the country. In a review of the progress during the few years since attainment of independence the public were given an opportunity to see the advances attained in a number of fields of public utility like agriculture, irrigation, health, education, transport, defence etc. At the same time it was reminded that it was not yet time to rest their oars but it was only a signal for further activities in all fields. We pray that the Republic may march from strength to strength in all activities for the well being of the Nation.

Progress of Cotton Research in Madras *

By

S. M. KALYANARAMAN

Cotton Specialist

Research in cotton in the State of Madras is directed towards the improvement of the various commercial cottons cultivated in this State in the different cotton tracts, namely, Cocanadas including *Chinnapathi*, Westerns including Mungari, Northerns including Red and White, Cambodias including Uganda or Rajapalayam cotton, Uppam, Nadam and Bourbon, and Tinnevellies including *Karunganni*. The improvement is sought in maximisation of yield, enhancement of quality, the introduction of resistance to pests, diseases and adverse environmental conditions and the increase of monetary return per acre to the growers of cotton. These improvements are attempted to be achieved by (A) adoption of plant breeding methods utilising the latest techniques, (B) agronomic experiments to determine the most suitable methods of economic cultivation of cotton and (C) the study of fundamental aspects relating to genetical behaviour of the several attributes in cotton and how best they can be utilised in breeding superior varieties. In the following paragraphs an attempt is made to summarise the progress achieved so far under these three heads.

A. BREEDING

1. **Cambodia:** The total area under this variety in this State is 4·10 lakh of acres of which 53·0% are sown to improved varieties. Cambodia cotton is cultivated both as an irrigated and unirrigated crop and during two definite seasons, either as a cold-weather crop sown in September — October and harvested by March — April, or as a summer crop sown in February — March and harvested in August — September. In the former practice sowings are done both under irrigated and rainfed conditions, whereas cotton during summer is confined to irrigated conditions in the East Coast namely South Arcot and in the Southern districts of Madurai, Ramanathapuram and Tirunelveli.

(a) *Irrigated Winter-sown Cambodia:* Cultivation during cold weather is spread over the Central and Southern districts in the State. A scheme for its improvement financed by the Indian Central Cotton Committee, is in operation to improve upon the existing strains of cotton under cultivation namely Co. 2 and M. C. U. 1 (Madras Cambodia Uganda 1). It also envisages the evolution of a cosmopolitan type of Cambodia cotton that would be adaptable for cultivation both in the

* A summary of the report on the progress of cotton research in Madras presented at the meeting of the Heads of Sections and others heldon 16 — 8 — 1952, the Minister for Agriculture, Madras presiding.

Central and Southern tracts where early and late-sown conditions of agricultural practices obtain. This is done with a view to avoid a multiplicity of strains under distribution and avoid the difficulties of maintaining purity and prevent the deterioration of strains under cultivation. The results so far obtained indicate an improvement in staple length by 4 to 5 mm. and in ginning percentage by one to three per cent. The most promising of the cultures under advanced stages of yield trials are Nos. 9030, 0744, 9995 and 0734. It is interesting to note that culture No. 0734 is found to be adaptable not only for the early and late-sown conditions but also for irrigated and unirrigated conditions. The evolution of such a strain will go a long way to bring the entire tract under one improved variety of Cambodia. Under Cambodia improvement work for winter sown conditions may be included the breeding work conducted at the Agricultural Research Station, Siruguppa under the auspices of a Scheme sanctioned by the Indian Central Cotton Committee. The results so far indicate the possibilities of evolving a type of Cambodia suitable for growing in black soils of the Ceded districts with the irrigation facilities that would become available with the advent of the Thungabhara project. H. A. 11, M. A. 2 and Laxmi varieties obtained from other States and acclimatised locally, are seen to come up well under the conditions of the trial. One other important finding as a result of the work at Siruguppa is the possibility of evolving varieties of cotton resistant to pests and diseases. For instance culture 2196 — a reselection from one of the interspecific hybrids of Surat, has been found to be consistently resistant to blackarm. Similarly culture 1821, also isolated at Siruguppa, is found to be definitely resistant to jassids. Apart from the utility of these in the tract for minimising crop losses due to pests and diseases, their use as resistant parents for hybridization work elsewhere in the state offers a wider scope.

(b) *Summer-sown irrigated Cambodia:* It is interesting to record that Cambodia cotton grown under irrigation during summer is as a rule better in quality than the same cotton raised during winter months. Previous research has shown that the conditions of temperature and humidity are more favourable for the development of long and fine fibres during summer than during winter. This experience coupled with the peculiar practice, namely cultivation of Cambodia cotton on single-crop wet lands with well irrigation between the months of February and August, in some parts of Ramanathapuram district, gave an impetus for intensive improvement work on summer cottons. Since this item of research is intended to improve the production of quality cottons in the State, it has received sufficient encouragement at the hands of the State Government as well as the Indian Central Cotton Committee. A Scheme (Long-Staple Cotton Scheme) financed by the Indian Central Cotton Committee was started in the year 1946 and is in progress. The object of this is to evolve varieties of Cambodia cotton suited to summer cultivation

and which possess a mean staple of $1\frac{1}{8}''$ capable of spinning 50's and over. By the adoption of such a procedure it was considered possible to produce long staple cottons which at present are in short supply in the Indian Union. This improvement work is located at the sub-station at Srivilliputhur in Ramanathapuram district. The trials so far made have indicated the suitability of No. 7682 now renamed as Madras Cambodia Uganda 2, to the summer-sown conditions. This cotton is capable of spinning upto 52's as against 44's for which Madras Cambodia Uganda 1 has been found to be suitable. Further, this new strain has been found by district trials to yield 20% of seed cotton more than Madras Cambodia Uganda 1, to possess higher ginning by 2% and to be earlier in duration by nearly two weeks, which feature is specially advantageous for summer cultivation under well irrigation. It is therefore proposed to multiply and distribute Madras Cambodia Uganda 2 in the districts of Madura, Ramanathapuram, Tirunelveli and South Arcot, for summer sowing. Besides this, the results of experiments at Palur have indicated that by a suitable shift in the time of sowing of summer cotton in South Arcot district not only the yields are increased three-fold but also the defect of contabesence of anthers is mostly overcome. In addition to these indications, the trial of *barbadense* types under the East Coast conditions has given very encouraging results and points to the possibility of developing *inter* and *intra-barbadense* hybrids suited to summer conditions. Such crosses are in various stages of trial and when finalised are expected to produce cottons of over $1\frac{1}{8}''$ in staple and suitable for spinning 60's warp yarn.

(c) *Un-irrigated Cambodia and Sea Island cotton:* Nearly one half of the area under Cambodia cotton in this State is normally raised as an unirrigated crop, mainly in the districts of Coimbatore, Salem, Tiruchirapalli and Madurai. Usually, in trade the mixing of the produce of unirrigated Cambodia with that from irrigated Cambodia tended to reduce the quality of the latter. This has spoilt the fair name of irrigated Cambodia in trade circles. Therefore, improvement work on rainfed Cambodia was started with the financial aid of the Indian Central Cotton Committee by the loction of a centre of cotton research at Periyakulam in Madurai district. Though this scheme has been in operation for only three seasons, the results obtained do indicate the possibility of evolving a cotton of one inch and over staple, capable of thriving well under rainfed conditions, yielding on an average 200 lb. of lint per acre and with a quality staple for spinning 40's yarn or better. A few of the cultures — 7604-8, reselection of Co. 4/B. 40 and a reselection from 4-4-1-1 have been found to be even better than Madras Cambodia Uganda 1 in yield and equivalent to it in quality. Under Periyakulom conditions Madras Cambodia Uganda 2 has been found to yield consistently better than Madras Cambodia Uganda 1.

For the unirrigated conditions in the black soils of Ceded districts, isolation of Cambodia types is in progress at Hagari and Nandyal. The results obtained at these centres indicate the adaptability of Laxmi and and a few reselections like 320 and 427 from M. A. 2, for such conditions.

With the object of exploring the possibilities of the cultivation of Sea Island cotton, the quality of which is known to be the best in the world, under West Coast conditions where rainfall, temperature and humidity trends are more or less similar to those in the West Indies, the wrok on acclimatisation and cultivation of Sea-Island in the West Coast was taken up as part of the Winter Cambodia Scheme for the last four seasons. The trials and experiments conducted so far indicate the possibility of successfully cultivating a hardy type of Sea Island cotton under rainfed conditions in the West Coast (Malabar and South Kanara). This possibility is of course conditioned, by the proper adoption of agricultural practices particularly adequate manuring. The present knowledge indicates that intensive manuring, transplanting six week old seedlings and timely prophylactic measures against insect pests are necessary for successfully cultivating this variety in the West Coast. This cotton so raised in the West Coast is found to be capable of spinning over 100 counts and is valued at Rs. 2,500/- per candy as against Rs. 1,000/- for good Cambodia.

Another phase of Cambodia improvement is the utilisation of favourable attributes possessed by certain wild cottons like *G. darwinii* and *G. taitense*, amongst the New World group and *G. raymondii* and *G. anomalum* in the Asiatic group. Study of hybrid derivatives involving the New World group wild cottons and cultivated Cambodia types has indicated the possibilities of evolving hardy types suited to irrigated and unirrigated conditions of Cambodia cultivation. Several promising cultures are under various stages of trial. A few of them have been found to be highly resistant to blackarm disease caused by *Phytomonas malvacearum*.

Another new feature of Cambodia improvement work is the recent attempt to cultivate cotton on the rice fallows in the State. This new line of work has been started in connection with the cotton extension plan which aims at increase in the production of cotton without adversely affecting the production of food crops. This venture was taken up because previous experience had proved the possibility of raising cotton on similar lands during summer in Ramanathapuram district. Moreover, earlier trials of different varieties on the Rice Research Stations in this State had given encouraging results. Based on all these, experiments of co-ordinated nature were conducted to compare several varieties, to determine the optimum date of planting and to assess the response to manurial treatments in thirteen agricultural research stations, after the harvest of paddy crop. The trend of the results so far obtained shows clearly that early duration varieties like P. 216. F and P. 23. F can successfully be introduced in all rice fallows where (a) facilities for irrigation during summer months exist, (b) where temperature - maximum and minimum - do not vary widely, but keep within the optimum limits and (c) where the rice-fallow period permits the cultivation of cotton crop of 4½ to 5 months' duration. Already the success of cotton cultivation on such lands has been proved by the spread of P. 216. F in the rice-fallows of Tanjore district. The varietal trials have indicated that several other types

superior in quality to P. 216. F can be introduced with even greater success. Similarly manurial trials have clearly shown that application of nitrogenous manures, to the extent of 40 lb. nitrogen, contributed to higher yield of cotton. The best time for planting has been observed to be early in January, immediately after the harvest of paddy. The trials are still in progress and when sufficient experience on the suitability of varieties and methods of cultivation including control of pests and diseases have been gained, it would be possible to extend this practice to rice-fallows in other districts and thus increase the production of quality cotton in this State, to an appreciable degree.

2. **Nadam Cotton**: The area under this variety is only 0·06 lakh of acres and is confined to the shallow gravelly soils of the Erode taluk of Coimbatore district. With the advent of the Lower Bhavani project, a major portion of this tract is likely to come under irrigation, though there might be still patches here and there not benefited by the project. Therefore, improvement work on this variety is now restricted in scope. Breeding of early types is being carried out at Coimbatore. As a result culture B. 32-48/51 has been evolved. It is being tested out under ryots' conditions in the Erode taluk for adaptability to that environment. There are also other cultures, equally early but they require to be purified, before they can be tested out in the districts. Further studies with these promising cultures are planned to be carried out at the Agricultural Research Station, Satyamangalam where soil conditions are representative of the Nadam tract.

3. **Karunganni and Tinnevellies**: The normal area under this commercial variety is 5·46 lakh of acres of which 61·5% are already under improved strains, K. 5 in the Central districts and K. 2 in the Southern districts. It may be mentioned that the soil and climatic conditions vary considerably from district to district. Hitherto, no one strain of cotton was found suitable for the entire tract. Therefore, separate strains for the Central and Southern districts were being evolved and distributed from time to time. That, the simultaneous cultivation of more than one strain of Karunganni in contiguous districts was always responsible for mixing of varieties, wilful and otherwise, leading to great difficulties in the maintenance of purity of the strains under cultivation. Therefore, it was programmed to evolve by suitable breeding methods a cosmopolitan type of *arboreum* strain suited to both Central and Southern districts of Madras.

This attempt was greatly encouraged by the results obtained from a study of the progenies of several hybrid cultures at the Agricultural Research Station, Koilpatti where it was found that large variations for economic characters were present and therefore there was ample scope for obtaining useful results by the application of selection methods. Further indications were also there to point out the possibility of longer—stapled cottons capable of spinning upto 40's. Hence, a scheme was put into operation in June, 1949, with the financial assistance of the Indian Central Cotton Committee. During the short period of four years intensive studies of hybrid cultures have revealed that four of them are definite improvements over the existing Karunganni strains and are

adapted to both *Coimbatore* and *Koilpatti* environments. The performance of these in the several Karunganni growing areas is being tested by extensive scattered block trials. The results of these trials are expected to help in selecting the best of these promising cultures. Special mention may be made of cultures 6312-4 and 6874 which have been adjudged to be suitable for spinning 40's yarn consistently for the last three seasons. In ginning percentage and yield they are either improvements over the control or as good as the existing strain. Besides the above cultures quite a large number are in the lower stages of trial which have combined to a remarkable degree quality and yield, and it is expected that one or more of these may be even better than the most promising on hand now.

4. **Cocanadas**: The normal area under this variety is 0·96 lakh of acres of which 21·6% are now occupied by the improved strain Cocanadas 1. This variety of cotton is important in the cotton world on account of its natural colour. Years back the demand for this coloured cotton from Europe was great. In recent times, due to export restrictions and lack of sufficient local demand the price obtained for Cocanadas cotton as compared to other indigenous cottons of similar staple and style was very low. Consequently, this led to a gradual reduction in the area under this variety of cotton. The improvement work on this variety was started as early as 1931 at the Agricultural Research Station, Lam in Guntur and was intensified later under a scheme financed by the Indian Central Cotton Committee in 1941. As per the approved programme, the aim is to evolve a deeper-coloured and better stapled variety from the local unselected bulk as well as by suitable hybridisation. As a result two cultures better than C. 1 in colour and quality were obtained of which one is renamed as C. 2 and is being multiplied for distribution. The other one R. H. 25 is being tested under cultivators' conditions in the districts to find out its suitability for the tracts where Cocanadas cottou is cultivated. But in the meantime, the low demand for this coloured cotton and consequent poor prices obtained in the market has been an indication to revise the policy of breeding by switching over from coloured types to white types since the latter was more paying for the cultivators. With this changed objective suitable hybrid materials are being tested at varying stages for the evolution of a white type suited for different soils and sowing periods.

Along with the improvement of Cocanadas cotton, the improvement of short-stapled Chinnapathi is linked since the co-existence in the same tract of a short-stapled and medium stapled cotton is always an impediment for the maintenance of purity of the improved strains. Hence, improvement of Chinnapathi was sought to be achieved by the evolution of both coloured and white types which were early in duration and possessed a high percentage of ginning. In this connection, several hybrid progenies are under tests for the early sown conditions of the Chinnapathi area. In addition, a few types from the Punjab (I) have been found to be very adaptable to the local conditions. The trial of such cottons is in progress.

5. **Westerns**: This commercial variety of cotton normally occupies an area of 6·3 lakh of acres spread over the districts of Bellary,

Cuddapah and Anantapur. Of this area, at present 91·9% is covered by the improved strain W. 1. Since the year 1949 intensive studies are under way at the Agricultural Research Station, Hagari under the auspices of a Scheme (Westerns improvement Scheme) financed by the Indian Central Cotton Committee to improve (1) the yield of lint per acre obtained at present, (2) evolve drought-resistant starains and (3) minimise wastage in spinning compared to W. 1. Of the several cultures that are in the higher stages of trials, special mention may be made of four cultures namely 2711, 3870, 4272 and 4327. All these possess better fibre properties and a higher ginning percentage than W. 1. Then adaptability to the varying environments in the districts is being tested.

As mentioned earlier in this report, Mungari is a short-stapled trade component of Westerns cotton which is cultivated in the lighter soils of Bellary, Kurnool and Anantapur districts during the early season (June—July) to about December—January. The normal area under this cotton was about a lakh of acres but in recent times, due to competition from groundnut, the area under this variety of cotton has been considerably reduced. This variety is short-stapled and coarse, fit only for spinning yarns of about 10 counts. Since this variety is more or less cultivated interspersed in the westerns area, the scope for adulteration is great. Therefore, improvement work on this variety of cotton was undertaken from the year 1937 with the financial assistance of the Indian Central Cotton Committee in a scheme (Mangari Breeding Scheme) specially sanctioned for the purpose. The venue of work was located at Adoni where suitable light red soils are available for ex-perimental work. As a result of intensive breeding work one strain 881·F now renamed as Rayalaseema 1 has been evolved. This variety though slightly longer in duration is equal to the locals in yield but definitely better in quality, being capable of spinning 28 warp counts as against 10's for local Mungari. This strain is being multiplied for distribution in the Mungari tract. Furthor efforts to reduce the duration are in progress.

6. **Northerns:** This commercial variety of cotton occupies normally an area of over 1·18 lakh of acres, mainly in the district of Kurnool. Of this area, only 17·9 percent is now sown to the improved strain N. 14 distributed by the Department. Though this strain is one of the best of the indigenous cottons cultivated in the Indian Union and capable of spinning upto 40's standard warp counts, the scope for its spread is very limited on account of its suitability only to soils of lighter nature and to tracts with heavier rainfall. With a view to evolve a more cosmopolitan type of *arboreum* strain suited to the entire Northerns area a scheme for the improvement of Northerns Cotton was inaugurated in June 1949 with the financial assistance of the Indian Central Cotton Committee. Under this scheme, a large number of progenies from interstrain and intra-arboreum crosses has been subjected to trials in various stages. As a result, four cultures have been found to be equal to N. 14 in yield and quality but definitely superior in their ginning percentage to N. 14. The adaptability of these cultures to varying conditions of soil and climate is being tested out in the districts, from which the most promising ones will be multiplied and distributed. In the earlier stages of trial there are three promising cultures

namely 6116, 6234 and 6246. These are being tested for consistency of behaviour.

As a sequel to the evolution of improved strains in the several commercial cottons of this State, extension of their cultivation to benefit the cotton growers has been actively engaging the attention of the Department in maintaining their purity, their multiplication under controlled conditions and distribution of the pure seeds on a large scale. In achieving this objective seed multiplication schemes partly financed by the Indian Central Cotton Committee have been in operation for each of the important cotton strains evolved.

Madras Cambodia Uganda 1 cotton that has been found to be suitable for the Winter sowings also in the Central and Southern districts is being multiplied over an area of about 5,000 acres. It is ultimately proposed to cover with this strain an area of about 4 lakh of acres in the districts of Coimbatore, Salem, Madurai, Ramanathpuram, Tirunelveli and South Arcot. Arrangements have been made to multiply the seeds both at Srivilliputhur during summer and in Coimbatore distrct during winter. The annual production of pure seeds is arranged from an area of about 9,000 acres of seed farms in the two districts. The seeds from this area are being utilised for distribution in the districts of Salem and South Arcot also.

Karunganni strains K. 2 and K. 5 have been found to be useful in the Southern and Central districts respectively and to cater to the needs of about six lakh of acres in these areas the two strains are being multiplied in Tirunelveli and Coimbatore districts respectively over an area of over 40,000 acres of seed farms. It is expected that the seeds procured from these seed farms would be sufficient to cover the entire Karunganni area in the districts. The Westerns area W. 1 has been found to be better than ordinary Westerns and therefore efforts are continued to run 6,000 acres of seed farms in Bellary district. The improved strain is reported to have covered 91·9% of the total area under Westerns cotton. The improved strains of Cocanadas cotton namely C. 1 and C. 2 are being multiplied in an area of about 1,000 acres of seed farms with the object of ultimately covering the entire area under Cocanadas cotton.

B. AGRONOMIC STUDIES

As a result of extensive agronomic experiments the following conclusions and results have been achieved so far:

(1) Under irrigated conditions it was found that earlier sowing of Cambodia cotton resulted in higher yields and relative freedom from insect damage.

(2) Winter-sown irrigated Cambodia cotton required, for optimum growth, irrigation once a fortnight during the earlier stages and more frequently during the critical period of boll formation.

(3) Under irrigated conditions, closer spacing of plants in the row, rows being 2½ feet apart did not result in better yields. The optimum spacing for irrigated cotton was therefore found to be 2½ feet between rows and nine inches between plants in the row.

(4) Planting Cambodia cotton on the sides of ridges tended to establish a more uniform crop than that planted in beds, though there was no significant difference in the yield. However, there was a definite saving in irrigation water when the crop was planted in ridges.

(5) Associated cropping of clusterbeans with summer cholam preceding Cambodia cotton was found to remove the ill-effects of cholam on Cambodia cotton.

(6) Cambodia cotton after a fallow period or a groundnut crop was found to yield better than after a ceral crop like Cholam or Ragi.

(7) In the manurial trials it was found that cotton generally responded to the application of nitrogenous manures. Under irrigated conditions, 60 to 80 lbs. of nitrogen resulted in better yields of cotton, whereas under rainfed conditions in regions where the annual rainfall was more than 25 inches, cotton yields were enhanced by the application of 40 lbs. of nitrogen in the form of either ammonium sulphate or groundnut cake.

(8) In Coimbatore tract a better preparatory cultivation for cotton was found in immediately ploughing the land after harvest of the previous crop of Cholam in order to remove the stubbles.

(9) In the Tinnevelly tract it was found that mixing of indigo with the previous crop of Irungu Cholam tended to increase the yield of cotton succeeding, thereby mitigating the ill-effects of fodder cholam.

(10) Agronomic experiments to determine the minimum preparatory and after cultivation necessary for cotton under rainfed conditions clearly indicated that deep preparatory cultivation was not necessary and that keeping the land free of weeds was the only after cultivation that was necessary under rainfed conditions.

(11) Experiments on mixed cropping revealed (1) that a legume mixed with a cereal preceding the cotton was better than a cereal alone (2) that cotton can be raised along with groundnut without any appreciable reduction in the yield of groundnut and thereby increasing the gross return per acre for the grower and also increasing the output of cotton in the State (3) similarly experiments proved that cotton along with chillies can be successfully raised in tracts like Guntur and (4) with Ragi in South Arcot and Chingleput districts.

C. FUNDAMENTAL STUDIES

(a) As a necessary adjunct to researches connected with the breeding of improved strains of cotton to suit different soil climatic conditions, to evolve superior qualities suitable for spinning the finer yarns and to isolate strains resistant to pests, diseases and adverse seasonal and environmental conditions, the section has also been devoting attention to the study of fundamental problems connected with the inheritance of economic characters such as lint length, maturity of lint, fineness of lint etc. Such studies have indicated that short lint is monogenic in inheritance, and that immaturity of lint in relation to lint length conforms to a dihybrid ratio. In the studies with lintless types indications have been obtained that the lintless type carries a gene for maturity which finds expression in the presence of the gene for lint. Cleistogamy in cotton is a simple recessive to normal flower opening. In addition to these studies, the inter-relationship that may exist between the several attributes of cotton is also sought to be studied by genetic analysis.

(b) Often in connection with seed multiplication schemes it has been experienced that seeds of one season are left over unsold for the next year. To study if such seeds can be safely utilised for sowing during the next year, storage experiments were instituted on a number of varieties of cotton—indigenous and exotic—the results from which indicated, that viability of seeds could be maintained for over two years at a high level provided conditions of storage were carefully attended to. This experiment, was continued to find out if seeds so

stored for over one year when used to raise a crop would result in the same cropping power as fresh seeds. For this purpose field experiments were conducted simultaneously in all the cotton sub-stations and the results therefrom amply demonstrated that the use of old seeds did not in any way affect the yield levels.

(c) Reports from elsewhere claimed that pre-soaking of cotton seeds in certain chemical solution resulted in enhancement of yield when such treated seeds were sown. This claim was arranged to be confirmed by regular experiments conducted at five different localities covering three exotic types and four indigenous varieties. The results of the experiment indicated that due to pre-treatment of seeds in molar, half-molar and quarter-molar solution of mono-potassium phosphate or ammonium sulphate did not result in increase of yields or any alterations in the seed and lint characters.

(d) Experiments to explore the possibilities of vegetatively propagating cotton, especially hybrids which naturally tended to segregate in subsequent generations, conducted at the Cotton Breeding Station, Coimbatore during two seasons indicated that the treatment of cuttings of cotton stems with Seradix—B. 3 resulted in a high percentage of rooting. The possibility of vegetatively propagating cotton was thus indicated.

(e) In connection with the study of the inheritance of the resistance to Blackarm and jassids, several crosses made between resistant and susceptible types and the hybrids are in various stages of study representing inheritance and the principal factors responsible for the resistance to the diseases and pests respectively.

To sum up the results of various activities of the section, it may be said that improved strains of cotton resulting in extra income per acre to the cultivators has been achieved in the case of all the commercial cottons in the State. Again, further researches in the matter of improving quality have already shown signs of promising results in the evolution of quality cottons which can compare favourably with the imported East African Styles. Apart from these, by fundamental and agronomic studies optimum conditions under which cotton can be grown with advantage have also been evolved. The results of such experiments have already been included as items of propaganda in the districts. The economics of cotton research and extension of the results therefrom, are indicated in terms of money value in the accompanying table, from which it would be seen that due to cotton research and extension, the annual additional income to the Cotton growers is over four crores of rupees.

Value of Cotton Research and Extension Thereof

Zone	Improved seeds	Extra lint (pound) per acre	Additional income per acre	Area covered acres 000's	Estimated extra income for the State (lakh of rupees)
	A. BREEDING				
Central and Southern Districts	Cambodia—2	30	42	42·5	17·9
Southern Districts	Madras Uganda—1	27	55	95·4	52·5
	Madras Uganda—2	27	55	(Released in 1951—1952)	
	Karunganni—2	23	30	217·8	65 3
Central Districts	Karunganni—5	35	40	117·7	47·1
Deccan	Westerns—1	9	9	370·2	33·3
	881. F	—	15	2·7	0·405
	Northerns—14	—	3	20·1	0 6
Circars	Cocanadas—1	12	4	15·9	0·6
					217·705
	B. AGRONOMY				
Central Districts	Time of planting in Winter (Coimbatore)	120	120	2·5	3·0
Carnatic	Time of planting (summer) South Arcot	120	245	1·0	2·4
Central and Southern Districts	Application of Ammonium sulphate	100	100	13·0	13·0
					18·4

Zone	Improved seeds	Extra lint (pound) per acre	Additional income per acre	Area covered acres 000's	Estimated extra income for the State (lakh of rupees)
	C. EXTENSION OF AREA				
	Introduction of cotton in rice fallows (Carnatic)	200	200	1·8	3·6
	Mixed cropping of groundnut and cotton (Circars) Chillie cotton	40	40	34·0	13·6
	Mixed cropping of groundnut and cotton (Deccan)	40	40	6·9	2·8
	Mixed cropping of Ragi, groundnut and cotton (Carnatic)	37	37	2·7	1·0
					21·0
	D. LEGISLATION OF COTTON CONTROL				
Central and Southern Districts of Carnatic	*Certification of exempted cottons:*				
	Madras Uganda—1 (Summer) at Rs. 250/- per bale on 20,000 bales				50·0
	Madras Uganda—1 (Winter) at Rs. 200/- per bale on 50,000 bales				100·0
					150·0
				Total	407·105

Aluminium in Plant Nutrition

By

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The metal aluminium is one of the relatively abundant elements in the earths' crust and as such it is a constituent of almost all soils. Inspite of its abundance, its essentiality for plant growth is still not definite, although its presence has been observed in minute quantities in most plants.

It exists in all flowering plants, in widely varying amounts, from 6 mg. per kgm. of dry matter in sugar beet, upto 1640 mg. per kgm, in beans. Grains and seeds as a rule are very low in Aluminium - content. Green leafy vegetables ordinarily contain the highest proportion of Aluminium. It accumulates more rapidly during early growth than later, more abundantly in the leaves than elsewhere and particularly so in the greenest leaves than in pale or etiolated ones. Fleshy succulent fruits have usually a medium content of Aluminium., but strawberries seem to be an exception as they are relatively rich in this metal. Edible roots have less than ordinary roots. Bulbs and tubers have a medium Aluminium., content, but the onion bulb is especially rich as in other metals.

One curious feature is that *xerophytes* are as rich in Aluminium as *hydropvytes.* Among the *Pteridophytes* in the ferns like *Aspidium* and *Polypodium,* Aluminium deficient plants were found to be more sensitive to frost. In *Lycopodiums* several species are found to behave as Aluminium accumulators as also one or two species of *Euphorbiaceae.* The *Pecan* nut is another accumulator of Aluminium.

Being an amphoteric element, it is not surprising to find that Aluminium in soluble form is found in large amounts in soils that are strongly acidic as well as in strongly alkaline soils.

The first evidence of Aluminium toxicity is dwarfing of the plants and injury to the roots. Plants accumulate Aluminium, in the cortex, mainly in the protoplasm, with a concentration of it in the nuclei.

In the case of rice, toxic symptoms begin to develop in the concentrations of 1/7500 N. and above of Aluminium chloride. In sugarcane, too much Aluminium in the soil is believed to be one of the factors involved in the low fertility of some Hawaiian soils.

Soil phosphates, in concentrations equivalent to that of Aluminium are able to neutralise completely the toxicity of an excess of Aluminium compounds in the soil. Liberal dressings of organic matter are also helpful in counteracting the effects of Aluminium, upon sensitive crops.

One of the most interesting features of Aluminium, nutrition, is its ability to change the colour of flowers from pink into blue. Thus in *Hydrangeas*, pink flowers can be changed to blue by spraying them with a 2·5% solution of aluminium sulphate. When the buds are sprayed repeatedly (five times) with aluminium sulphate, it is possible to secure blooms of uniform blue. The injection of Aluminium, sulphate into the stems of normally pink-flowered *Hydrangea* plants also influences the colour and if a fairly deep cut is made near the base, it is possible to obtain completely blue umbels.

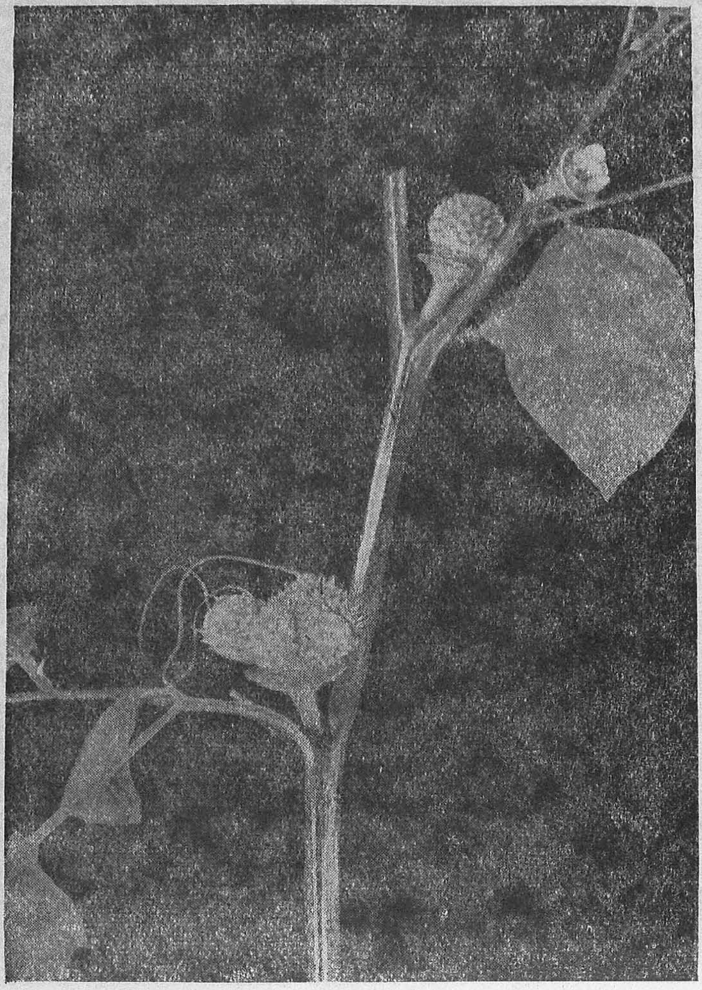
In the cultivation of *Cyperus malaccensis* which is grown in Japan for making nets, application of Aluminium sulphate to the soil had a distinctly favourable effect upon the growth, yield and quality of fibre. Other workers have also reported improved growth in a few other crops by supplying small amounts of Aluminium salts to the soil, but considering the narrow margin that exists between optimum and toxic levels; this is not a practice that can be advocated for general adoption.

Research Note

A Note on Paddy Straw Treatment for Improvement of Feeding Quality

The quality of paddy straw as a feed could be increased in two ways. One by improving its feeding value as assessed by increased calorific value of the straw and the other by reducing the high contents of certain substances like potassium and oxalates which are present in deleteriously high amounts in the paddy straw. Work done at the Veterinary Research Institute, Izatnagar (3) and at the Agricultural Research Institute, Coimbatore (2) had indicated that the quality of straw as a feed could be increased in both the counts mentioned above by the alkali treatment (i.e. straw treated with 8 times its weight of 1·25% alkali). It has recently been indicated (1) that mere water washing of the paddy straw improves its quality as a feed.

In order to get definite data on this point, a small quantity of paddy straw was soaked with 8 times its weight of distilled water and left overnight. It was subsequently washed, dried and taken up for analysis with the original untreated sample.



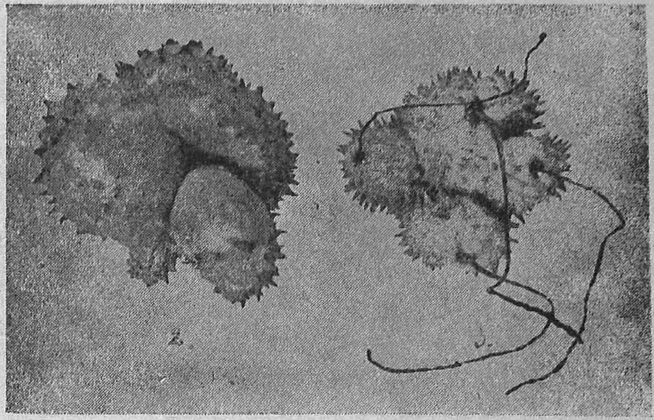
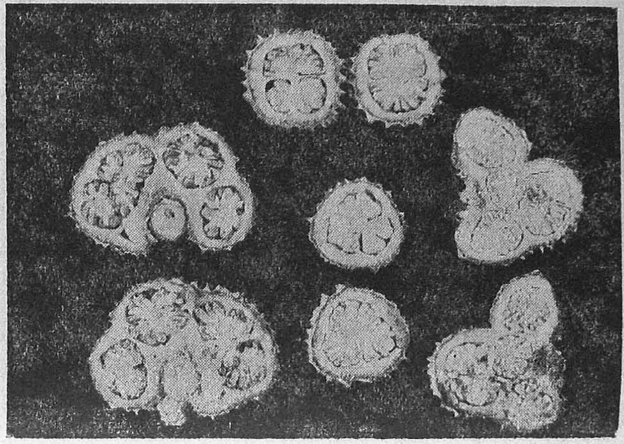


Fig. 2 Fig. 3



The results of analysis are given below :-

Heads of analysis	Before water treatment (%)	After water treatment (%)
Moisture	8·24	28·30
On oven dry basis :		
Minerals	20·52	21·69
Insoluble matter	16·84	19·23
Crude fibre	26·37	26·08
Potash as K_2O	1·53	0·64
Oxalates as oxalic acid	0·895	0·444

From the results of analysis it will be evident that nearly 50% of the potash and oxalates are removed by water washing alone. But there is no tangible change in the contents of minerals and crude fibre. The water washing is not also as effective as alkaline treatment wherein nearly 70% of the harmful oxalates and potash were removed. Its chief advantage lies in its cheapness and easy adoption by every farmer without any technical intricacy.

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30th November 1953.

A. MARIAKULANDAI.

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Polycarpy in Datura fastuosa Linn.

The fruits of *Datura fastuosa* L. are capsules, generally developed from a syncarpous ovary. The ovary usually carries a single style. One plant developing many abnormal fruits was noticed in the Agricultural Research Institute, Coimbatore. Most of the fruits of this plant were abnormal with varying numbers of partially free carpels, very often with 3 to 5 carpels developing half apocarpously. Each of the carpellary projection carried an individual style. (Fig. 1, 2 and 3). Transverse sections of the fruits also (Fig. 4) bring out this feature clearly. However, the placentation has been found to be very irregular in fruits with more than three carpels.

In plants which have normally a reduced number of carpels as compared with that of the members of the other whorls of the flower, increased number of carpels have been recorded. These cases may be regarded as reversions to a larger number of carpels which probably constituted the original ovary. Five carpels have been recorded (Worsdell 1916 — The Principles of Plant Teratology - Vol. II) in *Linaria vulgaris* and *Spilanthes* and four carpels in *Cleome spinosa* instead of the two characteristic of the orders *Scrophulariaceae*, *Compositae* and

Cruciferae respectively. In the characteristically monocarpic *Leguminosae* and *Rosaceae,* five carpels in *Mimosa* two to three carpels in *Trifolium repens,* two carpels in *Phaseolus multiflorus* and two to five carpels in *Prunus* and *Amygdalus* have been recorded. In *Gingko biloba* and in the double flowers of *Delphinium* an increase in the number of carpels has also been recorded by Worsdell. The bicarpellary condition of *Datura* must be a case of reduction from its original number five, of which all the whorls of the flower once were composed. The increase in the number of carpels upto five in the present case under record can be regarded as a reversion.

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Fimbristylis miliacea Vahl. — A New Host for *Striga euphrasioides* (Vahi.) Benth

Striga is a semi-parasite on roots of other flowering plants. Fortynine species of *Striga* are known. The distribution of this genus appears to be confined to tropical regions of Africa, India, South East Asia, East Indies and Australia (Pearson 1913; Wilson Jones 1953). In India, six species of *Striga* have been reported to occur (Hooker 1885; Gamble 1228; Santapau 1950). Of these, *S. asiatica* (L.) Kuntze (*S. lutea* Lour.) and *S. euphrasioides* (Vahl.) Benth. are very common. Both these species enjoy a very wide range of host plants. Kumar and Solomon (1941) have given a detailed host list for four species of *Striga* occurring in India. According to these authors, *S. euphrasioides* has been found to parasitise members of *Cyperaceae, Gramineae, Polygalaceae* and *Rubiaceae.*

Recently *S. euphrasioides* was found parasitising *Fimbristylis miliacea* Vahl. (Cyperaceae), a common sedge of the rice fields, in the wetland area of the Central Farm, Coimbatore. The roots of *S. euphrasioides* were found to be attached to those of *Fimbristylis miliacea* by means of lateral haustoria. This species has not so far been recorded as a host for *S. euphrasioides* or for any other species of *Striga* known to occur in India.

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Mycology Section, Agric. Coll. & Res. Inst. Coimbatore: 5th January 1954.

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C. L. SUBRAMANIAN.

EXTRACTS AND GLEANINGS

Mechanical Cultivation and Harvesting of Wet Paddy in Malaya: Emphasis has been laid on investigations within the 'hard pan' zones of the coastal alluvial clays derived from mangrove swamps where cultivation is mainly carried out by a short chipping scythe. In reference to soils water relationships four possibilities were laid viz., (i) dry cultivation followed by drilling or seeding in dry soil with subsequent irrigation, (ii) dry cultivation by flooding and transplanting as usual, (iii) wet cultivation followed by transplanting and (iv) dry cultivation followed by flooding and seeding in shallow water. No. 3 gave higher yields. On the so called "bottomless" soils only dry cultivation is possible and success depends on the use of low bearing pressure tractors, since these soils have high water table in the cultivation season and cultivation becomes progressively difficult after the completion of the first cultivation. For this reason an implement such as a tractor mounted or tractor-drawn rotary hoe which produces tilth in one operation is advantageous.

Preparation of Paddy Land: In the hard pan soils since deep cultivation has been shown to offer no advantages over shallow cultivation the ideal implement for the first two operations has usually been a mounted mould board plough with semi digging bodies. After-cultivation with the soil wet is best carried out by a double or triple notch pole of a weight and size suited to the particular tractors. Several adoptions for wheeled tractors such as a wide gauge tractor, fitting standard wheeled tracks by using large-size rear wheels or out-size 'rice' types on standard size wheels etc. are described.

Seedling or Planting: Not much progress done. Only limited attention has been paid. The old fashioned 'fiddle' type of hand broad caster of germinated seedlings has given useful results. Anyway for the present a nursery has to be maintained to transplant in case broadcasting fails. Whenever broadcasting by fiddle succeeds on a small scale so also will broadcasting from aircraft succeed on a larger scale. This also helps solve problems of weed control and fertiliser top dressing.

Weeding the Growing Crop: Methods like (i) preplanting cultivation, (ii) offseason cultivation with dry land crops, (iii) complete water control, (iv) use of selective herbicides were tried. The third method was ideal but not against swamp weeds in a broadcast crop but was efficient in a transplant field. The fourth method with 2-4 D, M. C. P. a commercial dust based on hormones were tried using a portable engine-driven knapsack duster. Dusts were found less effective than sprays and neither was effective against sedges and many swamp grasses. Use of aircraft for spraying weedicides (American method) were tried but the danger of drift to other crops is excessive. So it can be used only to areas where no other crop is grown.

Application of Fertilizers: Where fertilizers give a response in yield, the phosphorus and potassium fertilizers are best applied before planting or before final cultivation whereas most of the nitrogen is best applied as a top-dressing either broad casting or placement in wet soil. The first can be mechanized using standard manure distributors but nitrogen top dressing will have to be done by hand. Application in pellet form from air is possible but is unlikely to be economical.

Irrigation Control: The ability to withdraw water or to put it on the land at will is normally considered essential for mechanised cultivation. The difficulties with Malayan soils and conditions are mentioned. "On most bottomless soils

areas the clays and bog soils are so permeable that localized water control is much more limited. This physical character of old mangrove soils require some emphasis as it is not generally realized that irrigation water during the growing season forms a continuous phase downwards into the soil and that the whole land surface may move up and down with the flow and ebb of tides. Under such conditions it would be unreasonable to expect the degree of water control that obtains on inland soils with a puddled pan."

Harvesting Operations: Mechanization at present forms a serious obstacle until its associated problems are approaching solution especially, in under-populated areas. The peak labour requirements arise mostly owing to uniform planting and the sudden onset of dry weather lead to such uniformity of ripening that any delay in reaping results in losses from shedding. The conventional method is similar to that in South India.

Mechanisation of either cutting or threshing would greatly ease the peak labour requirements at harvest and that when full mechanization is not required it will be wasteful to use a combine harvester. For machanised harvest the type of paddy grown should ripen uniformly, not shatter too easily, have stiff stout straw, and not liable to lodge. Trials with conventional cutter bars showed cutting was easy but later considerable labour was required to arrange the tangled swathe in sheaves for normal threshing. With reaper binder it was found that when dead ripe considerable shattering occurred and when cut early heating when stooked, sun-cracking etc. took place. A prototype header gave some promise of success. With combines the problem has been flotation, the wheels sinking into the bog upto the chassis and increasing draught. When a large-scale farm is laid specially for mechanised paddy cultivation the type of selfpropelling combine harvester which has given results elsewhere in South East Asia may prove successful. Several other threshers like Tullos thresher, Robinson, Midget thresher, Turner Economy thresher were used and showed lowering of labour requirements. (A review of investigations into the mechanical cultivation and harvesting of wet paddy with special reference to the latter. Alleen E. F. and D. W. H. Hayees. Malayan Agricultural Journal. vol. 2. 1953; 161—180). N. K. S.

Weather Review — For the month of December 1953.

RAINFALL DATA

Division	Station	Total rainfall for the month in inches.	Departure from normal in inches	Total since 1st January in inches
Orissa & Circars	Gopalpur	..	—0·5	50·0
	Calinga-patnam	..	—0·5	45·2
	Visakha-patnam	..	—0·6	34·4
	Arakuvalley*	0·0	—1·0	47·3
	Anakapalle*	..	..	..
	Samalkot*	..	..	..
	Kakinada	..	—0·7	40·7
	Maruteru*	..	..	..
	Masuli-patnam	..	—0·7	39·6
	Guntur*	..	..	..
	Agrl. College, Bapatla*	..	—1·5	31·1
	Agrl. College, Farm, Bapatla*	..	—0·5	24·7
	Renta-chintala	..	—0·1	32·6
Ceded Districts	Kurnool	..	—0·2	33·5
	Nandyal*	..	..	..
	Cuddapah	..	—0·8	19·5
	Kodur*	..	..	..
	Anantapur	..	—0·3	34·1
Carnatic	Nellore	..	—2·9	28·3
	Buchireddi-palem*	0·2	—2·8	28·4
	Madras (Meenam-bakkam)	1·5	—4·0	37·6
	Tirur-kuppam*	0·4	—5·4	37·7
	Palur*	1·7	—4·8	39·3
	Tindivanam*	1·1	—3·1	31·5
	Cuddalore	2·8	—4·7	41·6
Central	Arogyavaram (Chittoor dt.)	0·1	—0·9	34·1
	Vellore	0·5	— 2·1	30·4
	Gudiyatham*	0·3	— 2·4	26·9
	Salem	0·1	— 0·9	51·2

Division	Station	Total rainfall for the month in inches.	Departure from normal in inches	Total since 1st January in inches
Central Contd.	Coimbatore (A. M. O.)*	0·8	— 0·6	32·4
	Coimbatore	0·1	— 1·3	30·8
	Tiruchirap-palli	0·3	— 2·3	41·4
South	Naga-pattinam	5·7	— 5·3	39·7
	Aduturai*	1·9	— 2·1	27·7
	Pattukottai*	3·3	— 0·5	37·8
	Madurai	0·4	— 1·6	45·5
	Pamban	3·3	— 4·3	31·9
	Koilpatti*	0·4	— 1·7	26·1
	Palayam-cottai	0·6	— 3·6	27·4
	Amba-samudram*	4·3	— 1·7	40·1
West Coast	Trivandrum	1·5	— 1·0	75·5
	Fort Cochin	0·9	— 0·7	112·7
	Kozhikode	..	— 1·5	98·0
	Pattambi*	..	— 1·3	80·5
	Taliparamba*	..	— 1·4	104·8
	Wynaad*	Tr	— 0·8	87·8
	Nileshwar*	..	— 0·7	126·2
	Pilicode*	..	— 1·0	113·3
	Mangalore	..	— 0·7	113·9
	Kankanady*	..	— 0·6	118·0
Mysore & Coorg	Chitaldrug	..	— 0·5	20·1
	Bangalore	..	— 0·4	47·3
	Mysore	..	— 0·4	37·4
	Hagari	..	..	..
	Siruguppa	..	..	..
	Bellary	..	— 0·1	28·1
	Mercara	..	— 0·7	128·2
Hills	Kodaikanal	3·2	— 2·0	64·7
	Coonoor*	1·8	— 5·3	60·3
	Ootacamund*	Tr	— 2·3	60·5
	Nanjanad*	0·1	— 1·5	73·6

Note:— 1. * Meteorological Stations of the Madras and Andhra Agricultural Departments.

2. Average of eight years' data for Arakuvalley is given as normal.

3. Tr = 1 to 4 cents of rain-fall.

Weather Review for December 1953

A low pressure area lay over the South Bay of Bengal on 4-12-1953 but became less marked on the very next day and moved away westwards across the extreme South-west Bay. Dry weather prevailed over the region from 2-12-1953 to 10-12-1953. A low pressure wave moved westwards across the extreme south-west Bay of Bengal on 9-12-1953 and passed away across the Comorin Maldives area on 12-12-1953. This was replaced by another low pressure wave over the extreme South-west Bay on 13—12—1953, which moved away westwards across the Comorin-Maldives area on 16—12—1953. Under the influence of the two waves rainfall occurred at a few stations in the Tamil Nad from 11—12—1953 to 16—12—1953, with a few heavy falls in South Tamil Nad.

A fresh low pressure wave moved westwards across the Sout-west Bay on 17—12—1953. and over the Comorin area on the next day. Two other low pressure waves passed over the same area on the 21st and 23rd December 1953. Yet a spell of dry weather prevailed over the Region from 17—12—1953 to 24—12—1953.

Another low pressure wave was moving across the Ceylon - Comorin area from 24—12—1953 and finally passed away westwards across the Maldives area on 28—12—1953. Under its influence rainfall occurred at a number of places in Tamil Nad during the period 25—12—1953 to 28—12—1953.

A low pressure wave was moving westwards across the extreme South Andaman Sea on the last day of the month.

A series of five western disturbances passed across the extreme North of India during this month.

The noteworthy rainfall and the Zonal rainfall for the month are furnished hereunder.

Date	Name of place	Rainfall for past 24 hrs.
14—12—1953	Pamban	2·1"

Zonal rainfall for the month

S. No.	Name of Zone	Average rainfall for the month in inches	Departure from normal	Remarks
1.	Orissa & Circars	0·00	— 0 64	Below normal
2.	Ceded Districts	0·00	— 0 35	,,
3.	Carnatic	1 10	— 3·96	Far below normal
4.	Central	0·31	— 1·50	,,
5.	South	2·49	— 2·60	,,
6.	West Coast	0·24	— 0 97	Below normal
7.	Mysore & Coorg	0 00	— 0 50	,,
8.	Hills	1·28	— 2·78	Far below normal

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13—1—1954.

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Departmental Notifications

Gazetted Service — Posting and Transfers

Madras State: Gomathinayagam Pillai, V., on leave, Millets Specialist, Coimbatore; Kacheppeswarn, S. S., Special D. D. Madras, D. D. Vellore; Mohamed Ali, A., Special D. D. Crop Sampling Madras, Senior D. A. O. Crop Sampling Madras; Natesa Iyer, K. V., D. A. O. Madurai, Secretary, South Arcot Market Committee, Cuddalore; Santhanam, K., Additional D. A. O. Trichy, D. A. O. Madurai; Uthaman, P., on leave, S. D. O. Vellore; Umapathy, M., Assistant Engineer, Teacher Work shop, Coimbatore, Assistant Engineer, (Inspection) Madurai.

Upper Subordinates

Madras State: Abu Bucker, D., A. D. Ramanathapuram, Non-Gazetted Lec. in Agriculture, Gandhigram; Alagappa Pillai, S., Special A. D. Melur, A. D. Ramnad; Achuthan, V., A. D. Pollachi, A. D. Alathur; Arunachalam, S., Paddy Assistant, Aduturai, Res. Asst. Agron. Aduturai; Bhaskaran, A. R., A. D. Kulitalai, Exten. Officer, Musiri, Balakrishnan M. P., Assistant in Pulses, A. D. Nannilam; Balasubramaniam, H., A. A. D. Ambur, A. A. D. Katpadi; Balasubramaniam, S., F. M. Pattukottai, Special A. D. (Cotton) Mannargudi; Chami, A., Special A. D. Uthamapalayam, A. D. Srivilliputhoor; Ekambaram, C., on leave, Pulses Assistant Tirupathoor; Fernandez, A., Paddy Asst. Coimbatore, Paddy Assistant Aduthurai; Govindaswami, T. N., Special A. D. Madurai, A. D. Athur; Ganesa Pillai, S., Special A. D. Ambasamudram, A. A. D. Ambasamudram; Ganapathi, T., A. D. Tirchendore, Special A. D. Cotton Coimbatore; Jayaraman, M., Spacial A. D. Nilakottai, Fruit Assistent Cashewnut, Mangalore; Krishnan, R. H. Paddy Asst. Ambasamudram, F. M. Paramakudi; Kannan, R. R., Asst. in Ent. Coimbatore, A. A. D. Aduthurai; Mahadevan Pillai, K., Spl. A. D. Tenkasi, A. D. Arni; Manimanthri, C., A. D. Trichengode, A. D. Hosur; Muthuswami, P. N., A. D. Coimbatore, A. D. Pollachi; Narayanan, K., Spl. A. D. Kulitalai, Spl. A. D; Sugarcane, Kulitalai; Nanjayan, K., Special A. D. Karur, A. D. Tirukoilur, Nagarathinam, Pulses Asst. Tirupathoor, Pulses Asst. Coimbatore; Purushothaman. P. S., A. D. Chidambaram, Spl. A. D. (Cotton) Chidambaram; Purushothaman, G., Paddy Asst. Palur, Paddy Asst. Coimbatore; Ratnasabapathi, V., Spl. A. D. Lalgudi, A. D. Trichy; Ranganathan, S. R., Spl. A. D. Madurai, A. D. Srivaikuntam; Ratnasabapathi, N., Spl. A. D. Madurai, A. D. Tirupathoor, Ramnad; Ramasubbu, G., Spl. A. D. Tinny, A. D. Tiruvannamalai; Ramabadran, on leave, Asst. in Millets Coimbatore; Ramaswami, N., Spl. A. D. Hosur, A. D. Trichengode; Rangaswami, S., A. A. D. Katpadi, A. A. D. Ambur; Sivaramakrishnan, K, Spl. A. D. Tirumangalam, Exten. Officier, Kanchipadi; Sivasubramaniam, T., Tech. Asst. D. A's. Office, S. D. A. Gundi; Soundirarajan, R., Spl. A. D. Trichy, A. A. D. Turaiyur; Subbaya, K. K., Spl. A. D. Periakulam, A. D. Peravurani; Sivappa, A. N., Spl. A. D. Melur, A. D. Arupukottai; Selvaraj Carvelho, G., Spl. A. D. Tinny, A. D. Krishnagiri; Sennayan, P., Spl. A. D. Trichendur, Cotton Asst. Koilpatty; Srinivasan, A. V. S., Spl. A. D. Srivaikuntam, A. D. Omalur; Sankaran Unni, T., Spl. A. D. Pattambi, A. D. Perintalmanna; Sambasivarao, I. K., Ft. Asst. (Cashewnut) Mangalore,

Ft. Asst. Model Orchard, Mangalore; Thamburaj, D., Spl. A. D. Musiri, P. P. A. Trichy; Veeraraghavan, P. G., Asst. in Mycol. Coimbatore, A. F. M. Wynad; Venkataraman, K., Asst. in Millets Coimbatore, Asst. in Pulses Tirupathoor; Venugopal, K., A. A. D. Aduturai, Spl. A. D. (Cotton) Kumbakonam.

Upper Subordinate — Postings and Transfers

Andhra State: Apparao Reddy, B., Asst. in Chemistry, Bapatla; Murthy Raju, K., A. D. Kavali, P. P. A. Anantapur; Mohammad Baig, A. A. D. Pamarru, A. D. Nandigama; Nageswara Rao, P., Cotton Asst. Narasaraopet, Cotton Asst. Nandyal; Narasimaraju, P. V. L., A. A. D. Pratipadu, Asst. in Chemistry, Bapatla; Nageswara Rao, N., S. D. A. Kakinada, A. A. D. Pamarru, Padmanabha Rao, K., Agricultural Instructor, Bapatla, A. D. Giddalore; Ramamohan Sastry, V., Asst. in Chillies, Lam, Scientific Asst. Millets; Suryanarayana, J., Spl. A. D. Anakapalle, P. A. to D. A. P. Anakapalle; Syed Mahaboob Ali, Cotton Asst. Nandyal, Cotton Asst. Lam; Sri Ramachandramurthy, N., Cotton Asst. Lam, Asst. in Chillies, Lam; Sundara Rao, D. S., Scientific Asst. Millets, Ongole, Asst. in Chillies, Lam; Shaik Imam, A. D. Jammalamadagu, A. D. Nellore Dt.; Sadasiva Reddy, G., A. D. Chandragiri, A. D. Jammalamadagu; Suryanarayanamurthy, H., Asst. in Chemistry, Bapatla, Chittoore Dt.; Venkateswara Rao, T., Spl. A. D. Vijayawada, A. A. D., Vijayawada; Vamsavaradhanam, B. B., A. D. Nandigama, Visag Dt; Venkateswara Rao, S., A. A. D. Vijayawada, S. D. A. Amalapuram; Viswanathamurthy, K., A. D. Kanigiri, A. D. Chittoore Dt.